THE NEW YORK TEACHER,

AND

AMERICAN EDUCATIONAL MONTHLY.

SEPTEMBER, 1868.

SECONDARY EDUCATION IN GERMANY.

THE United States tend, more than any other political communities that ever existed, to similarity, not only of institutions, but of working details; and yet, neither in its constitution nor its statutes—much less in its customs, explainable by diverse origin—is any one of them an exact pattern of another, or, as far as may be, of the Federal Government. In other words, the most progressive race on earth, divided into some three dozen autonomous States, but bound together, with contiguous territory, under one federation, exhibits thirty-six varieties in almost every feature of a common form of government. From this may be appreciated the slowness of human advancement, which depends so largely upon the knowledge, by each part of mankind, of the state and progress of every other: knowledge that sooner or later engenders imitation.

Locke, in his private journal, divides into four the "principal parts or heads of things to be taken notice of" in reading. The third, which he thinks of most use, is "what things we find amongst other people fit for our imitation, whether politic or private wisdom; any arts conducing to the conveniences of life." Politic wisdom (*sapientia civilis*) may fairly include, among other things, the system of education in vogue with any people; and we have deemed it of possible advantage to lay before the readers of this journal information in regard to the schools of Germany, not, so far as we know, accessible in English. Without entering into all the particulars, we herewith present, in tabular form, a comparison of the *Hauptschule* of Bremen with the corresponding schools of this country. We have chosen the former, because we have been

[Entered according to Act of Congress, in the year 1868, by J. W. Schermerhorn & Co., in the Clerk's Office of the District Court of the United States for the Southern District of New York.]

N. B. The press are at liberty to copy, provided credit is given to "*The American Educational Monthly*, New York; J. W. Schermerhorn & Co. Publishers."

favored by Herr D. Ehnick with a copy of its Easter Programme, 1867–68, and because, with a few exceptions which we shall point out hereafter, its *cursus* is equivalent to those of the Prussian *Realschulen* (classical and polytechnic schools) and *Gymnasia*. We have selected, on the other hand, the Boston schools and Harvard College as presenting, on the whole, the best and most homogeneous gradation to be found anywhere amongst us. They are not, however, so different from similar institutions in other States that the absence of detail which obtains in their programmes, and which we have not attempted to remedy, will much impair the value of the comparison for American readers. Nor will such terms as "*common school* arithmetic," used for brevity's sake without explanation, be, we hope, unintelligible. With the German programme we have taken the liberty of omitting, under the head of Grammar, the items peculiar to that language, as well as of changing the order to suit our convenience.

With these remarks we will introduce the studies of the Bremen Preparatory School (the lowest section of the *Hauptschule*) and its analogue, the Boston Grammar School, which differs, nevertheless, in admitting girls to the course hereinafter described. The ages of the pupils on entering are very nearly the same. In Boston the Primary School age is five years, and, with promotions every half year, the Grammar School is reached at eight, the percentage of those under eight being but .0115. In reckoning the hours of recitation in the Grammar School, we have omitted from the nominal session of twenty-six hours the two hours a week consumed in recesses, and the other two given to physical culture, which in the German schools is optional, and apparently does not encroach on school-hours.

PREPARATORY SCHOOL (*VORSCHULE.*)	BOSTON GRAMMAR SCHOOL.
THIRD CLASS.	FOURTH AND THIRD CLASSES.
(26 Hours of Recitation a Week.)	(22 Hours of Recitation a Week.)
1. *Religion.*—4 h. w. O. T. Bible history, to Judges. Historical significance of the chief Christian festivals. Verses and hymns to be learned by heart.	1. *Religion.*—Reading from the Scriptures, and Lord's Prayer, by the teacher, every morning before school opens.
2. *German.*—8 h. w. Reading 2 h. Pieces to be repeated by the scholars singly and in unison after the teacher. Declamation, 1 h. A whole piece to be learned each week. Spelling, 3 h. Two written exercises weekly. Grammar, 2 h., as far as conjugation.	2. *English.*—Reading. Spelling. Elementary Grammar (Class 3.)
3. *Geography.*—4 h. w. Local, with general ideas of geography, and appropriate instruction in physics.	3. *Geography.*—Primary.
4. *Arithmetic.*—4 h. w. Numeration, addition, subtraction, multiplication	4. *Arithmetic.* — Intellectual and "Common School," with lessons in

and division, with any number of places.

5. *Writing.*—4 h. w.

6. *Singing.*—2 h. w. Practice in developing the ear and voice. Sacred and secular songs of moderate compass, in the simplest tone-relations (*Tonverhältnissen.*)

SECOND CLASS.
(30 Hours of Recitation a Week.)

1. *Religion.*—2 h. w. O. T. Bible history continued, to the separation of the kingdoms of Israel and Judah. Christian festivals reviewed. Verses and hymns learned.

2. *German.*—6 h. w. Reading and spelling, 2 h. w. Declamation, 1 h. w. Grammar, 3 h. w. Difference and precise definition of the parts of speech. The simple sentence. Weekly written exercises. The compound sentence begun.

3. *Geography.*—4 h. w. Preparatory acquaintance with mathematical and physical geography. General survey of topical geography. Europe and Africa.

4. *Arithmetic.*—4 h. w. Resolving, reducing, and the four operations in denominate numbers. Addition of fractions.

5. *Writing.*—4 h. w.

6. *Singing.*—2. h. w. Practice in solo execution. General understanding of musical signs. Sacred and secular songs of few and simple tone-relations. Training for a second in thirds and sixths.

7. *Natural History.*—2 h. w. Mammalia and birds.

8. *Latin.*—6 h. w. Exercises in reading. Declension of substantives and adjectives. Auxiliary verb *sum* in compound tenses. First conjugation. Comparison. Numerals. Pronouns. Oral and written translations of the examples.

FIRST CLASS.
(32 Hours of Recitation a Week.)

1. *Religion.*—2 h. w. O. T. Bible history finished, and the chief events in the life of Jesus examined. Verses, hymns, and the list of biblical writings committed.

2. *German.*—6 h. w. Reading and spelling, 2 h. w. Declamation, 1 h. w. Grammar, 3 h. w. The compound sentence continued. Weekly written exercises.

written arithmetic on the slate and blackboard.

5. *Writing.*—Also, drawing in drawing-books.

6. *Singing.*—1½ h. w. (*i. e.* 15 minutes every forenoon). Taught by the assistant teachers from a text-book.

SECOND CLASS.
(22 Hours of Recitation a Week.)

1. *Religion.*—*V. supra.*

2. *English.*—Reading. Spelling. Declamation. Elementary or "comprehensive" grammar. Composition.

3. *Geography.*—"Common School." Map drawing on the blackboard, and with pen and pencil.

4. *Arithmetic.*—Intellectual and "Common School."

5. *Writing.*—Also, drawing.

6. *Singing.*—1 h. w. By a music teacher, with a text-book.

7. *History.*—Of the United States. First lessons.

FIRST CLASS.
(22 Hours of Recitation a Week.)

1. *Religion.*—*V. supra.*

2. *English.*—Reading. Spelling. Declamation. Grammar. Composition.

3. *Geography.*—4 h. w. Asia, America, Australia. General review.	3. *Geography.*—Physical, "by occasional exercises; using Guyot's maps."
4. *History.*—2 h. w. The kingdoms of the East, to the Persian wars. The Greeks, to the Dorian migration, with especial attention to ancient geography.	4. *History.*—United States and England.
5. *Arithmetic.*—4 h. w. Subtraction, multiplication and division of fractions. Review and practical application.	5. *Arithmetic.* — Intellectual and "Grammar School," "omitting alligation, and all after applications of cube root."
6. *Writing.*—4 h. w.	6. *Writing.*—Also, drawing.
7. *Singing.*—2 h. w. Further knowledge of musical signs. Sacred and secular songs of a more difficult kind, within ordinary compass. Practice in two-part songs. Latin text, for the sake of a good vocalization.	7. *Singing.*—1 h. w. As in the preceding class.
8. *Natural History.*—2 h. w. Amphibious animals, fishes, and the lower orders of animals.	8. In place of this, Lectures in *Natural Philosophy*, with the aid of philosophical apparatus; and in *Physiology.*
9. *Latin.*—6 h. w. Second, third, and fourth conjugations. Deponent verbs. Prepositions, adverbs, and conjunctions. Weekly written exercises.	

These tables we design to let speak for themselves, but we may be permitted to refer to the evident disparity in religious training, of which the reason is obvious. Sacred history included, there is also a marked difference in historical instruction, which is accounted for by the fact that the Preparatory School is part of a series, while only a minority of Grammar School graduates pursue a higher course. The appearance of Latin in the German programme involves a like explanation, although, as we shall see, it is thought to belong to the outfit for practical life (such as the *Handelsschule* and the High School furnish). It is, we believe, true of both the schools under comparison, that the classes indicate either more or less than a full year in many cases. The smarter scholars skip classes and stay but a twelvemonth at most in any, while the duller stick, and are graduated after a much longer period. In the Grammar School the full course averages from six to seven years, but six and a quarter per cent. of the scholars are over fifteen years of age. A month's difference in being born may make a year's difference in the completion of one's education—*i. e.*, according as the child happens to be of age at the opening of the fall term in September, or just a little too young. Postponement once having taken place, the child seldom "catches up." The precocious boy thus born out of time, if pushed forward in spite of it, and sent to college unseasonably, in order to save nine or tenth months, is apt to repent it when he comes in competition with heavier metal, and of necessity goes under. When, however, the summer semester-begins in April and ends in September, as in Bremen, this embarrassment, if it arises at all, takes another shape. For Americans, the best time to be born is not later than August.

The Bremen programme shows that, at the close of the summer semester of 1867, the two parallel divisions of the First Class (IA, IAA) sent the following quotas to the higher schools: to the *Handelsschule* (Commercial School), 22; to the *Gymnasium*, 31. Others of the class, not accounted for, probably went no further in their education. Whether the figures just given represent the usual proportion of accessions to the two higher schools respectively, we cannot affirm. In the same year, out of 170 pupils admitted to the English High School of Boston, 160 were from the Grammar Schools, against 72 who joined the Latin School from the same source in a class of 117. Two from the Latin School went over to the High School, and the reverse not infrequently takes place, as the views or circumstances of parents vary. The average age of the boys thus admitted to the High School was 14.8 years, which may be regarded as the graduating age of the Grammar School, the average age of those coming from other sources being a trifle less. The average age of those who entered the Latin was 12.8, due to the fact that the youngest age of admission is 10 years, though few apply so young. Those who enter from other schools than the Grammar, average 13.5 years. Before leaving the *Vorschule* we may remark that it numbered in April, 1867, 299 scholars, while the average of the Boston Grammar Schools was 455.

The *Handelsschule* numbered, at the same date, 180 scholars, the accessions having been 17 from the *Vorschule*, 2 from the *Gymnasium*, and 6 from other schools. The Boston High School, on the other hand, reckoned a total of 249; of which school, before proceeding to the tabular comparison, we may quote first the declared object, "to provide those boys who have completed the course of study prescribed for the Grammar Schools with the opportunity of pursuing more advanced studies, and of completing a thorough and liberal English education," and next, what was said of it by the Rev. J. Fraser, in his recent report on the common-school system of this country to Parliament: "Taking it for all in all, and as accomplishing the end at which it professes to aim, the English High School at Boston struck me as the model school of the United States. I wish we had a hundred such in England."

COMMERCIAL SCHOOL (*HANDELSSCHULE.*)	BOSTON ENGLISH HIGH SCHOOL.
FIFTH CLASS.	THIRD CLASS.
(32 Hours of Recitation a Week.)	(24 Hours of Recitation a Week.)
1. *Bible Lessons.*—2 h. w. Review of O. T. history, with special regard to the didactic and prophetic Scriptures. Life of Jesus according to Matthew and John, especially His sermons and parables. Verses (from the Sermon on the Mount) and hymns appropriate to the chief church-festivals.	1. *Bible-learning.* — Not otherwise than in the Grammar School. (*V. supra.*)

2. *German.*—4 h. w. Grammar: Review of etymology, with thorough explanation of the parts of speech and of the simple sentence. Exercise in reading, with practical and grammatical explanations. Committing and reciting of fables, songs, and easy ballads. Composition: Descriptions, and reproduction of narratives.

3. *French.*—5 h. w. Orthoepy. Orthography. Grammar: Declension of the substantive, article, inflection of the adjective; personal, relative, possessive, demonstrative, and interrogative pronouns; the auxiliary verbs complete, cardinal and ordinal numbers. Written exercises. Translation. Memoriter exercises.

4. *History.*—3 h. w. Review of the studies of the Preparatory School. Greek history, to the battle of Chæronea.

5. *Geography.*—2 h. w. Topical, of Germany, with regard to its political divisions.

6. *Accounts.*—4 h. w. Geometric relations and proportions; application of the latter to the rule of three. Simple rule of three. Expression and notation of large groups of figures, abridgments in multiplication and division, ciphering with denominate numbers, ciphering with fractions, through multiplication; with exercise in practical modes of calculating with abridgments, together with head-reckoning.

7. *Drawing.*—2 h. w. Straight lines in different directions. Combination of straight lines into symmetrical figures, partly after diagrams on the wall, partly original. Curvilinear and mixtilinear figures, mainly ornamental, also after diagrams and original. The first exercises to be drawn in connection with printed outlines, the rest free in outline, with the pencil and (of easy execution) with the pen. Together with them, elementary instruction in form.

8. *Writing.*—2 h. w.

9. *Latin.*—4 h. w. Grammar: Review of the regular etymology; irregular etymology; the most important case-rules. Translations from the Reader. Exercises. Extemporalia.

10. *Natural History.*—2 h. w. Osteozoa.

11. *Singing.*—2. h. w. One and two-part singing for boys, of choral melodies and national airs.

2. *English.*—Review of preparatory studies—*i. e.*, reading, spelling, and grammar.

3. *French.*—A nearly parallel course.

4. *History.*—"General history," of all times and countries, in the briefest form.

5. *Geography.*—Review of modern, as studied in the Grammar School. Ancient.

6. *Mathematics.*—Review of Arithmetic. Algebra.

7. *Drawing.*

FOURTH CLASS.

(34 Hours of Recitation Weekly.)

1. *Bible Lessons.*—2 h. w. Review

(This class has scarcely any parallel in studies, as it has no year to represent it, in the English High School.)

of the foregoing cursus. Lives of the Apostles, especially the missionary travels of Paul; selections from the apostolic epistles. Bible-verses and hymns.

2. *German.*—3 h. w. Grammar: The compound sentence; exercises in reading and declamation, selected according to the pupils' progress. Narratives and descriptions, chiefly under the teacher's directions.

3. *French.*—4 h. w. Grammar: Review of the foregoing cursus. Regular conjugations (including the reflective verb) entire, with the rules for the changes of the past participle and the place of the pronoun near the verb. The absolute personal pronoun; the commonest irregular verbs. Translation of connected pieces; memoriter exercises.

4. *History.*—3 h. w. Tabular review of what has been already learned. Greek-Macedonian history, Alexander the Great and his successors. Roman history, to the end of the Republic. Ancient geography of Italy and the Roman provinces.

5. *Geography.*—2 h. w. Topical and political, of Denmark, Holland, Belgium, France, Switzerland, the non-German countries, the Austrian and Prussian monarchies. Review of previous lessons.

6. *Mathematics.*—2 h. w. Geometry: Fundamental ideas; theorems on the properties of angles and parallel lines, on the conjunction of triangles; the simplest constructions; bisecting the angle and the straight line; construction of the right angle.

7. *Accounts.*—3 h. w. The complex rule-of-three and its practical application in reckoning, *e. g.:* Computing of interest in the various modes; division of fractions, as much as possible mentally. Exercises in fractions in the four operations with abstract and concrete numbers.

8. *Drawing.*—2 h. w. Continuation of previous exercises. Elements of perspective drawing, with the aid of wire models. Various solid figures—pyramids, cones, cylinders, spheres—executed with two colors on tinted paper; use of the wiper. In connection: instruction in illumination.

9. *Writing.*—2 h. w.

10. *Singing.*—2 h. w. Two and many-part boys' singing, in preparation for a full-voiced choir.

11. *Latin.*—3 h. w. Grammar: Characteristic constructions of the

Latin syntax (conjunction, infinitive, participle); translations from the Reader; exercises; extemporalia.

12. *English.*—4 h. w. Orthoepy and orthography. Grammar: Regular forms, and the principal irregular verbs. Exercises and extemporalia. Learning by heart small pieces in prose and poetry.

13. *Natural History.*—2 h. w. Winter term: Review of vertebrate animals; articulates. Summer term: Botany.

Third Class.

(32 Hours of Recitation a Week.)

1. *German.*—3 h. w. Grammar: Metrical analyses. Exercises in reading and declamation. Prose and poetry from the Reader. The longer romances and ballads of Schiller; lyric poetry. Composition: Descriptions, narratives, and letters. Easy essays, and development of ethical ideas, under the direction of the teacher.

2. *French.*—4 h. w. Grammar: Review; complete conjugation of the irregular verbs; use of the auxiliary in conjugating; reflex and unipersonal verbs. Chief rules of syntax. Corresponding exercises, and reading from text-books; translations from oral delivery.

3. *Mathematics.*—3 h. w. Geometry: Review; theorems on parallelograms and trapezia, exercises in transformation and division, measurement and computation of rectilinear figures; geometrical proportions and the similarity of figures. Arithmetic: addition, subtraction, multiplication, and division of literal numbers; ciphering with powers, with positive and negative integral exponents. Theory of decimal fractions. Extraction of the square and cube roots, both literal and numerical; the decimal system.

4. *Accounts.*—4 h. w. Review of the studies of the lower classes. Continued proportion; alligation. Computing of tare, interest, discount, rebate, compound interest, compound rebate, day of payment, gold, silver and tin, insurance, freight. Mental arithmetic.

5. *Drawing.*—2 h. w. Further drawing after solid models; ornamental modelling in plaster. Elements of geometrical projection; draughting. Use of the case of mathematical instruments. Law of harmony in colors.

6. *Writing.*—2. h w.

7. *Latin.*—3 h. w. Review of the

Second Class.

(24 Hours of Recitation a Week.)

1. *English.*—"Blair's Rhetoric."

2. *French.*

3. *Mathematics.* — Algebra. Geometry. Trigonometry, with its application to surveying, navigation, mensuration, astronomical calculations, etc.

4. *Accounts.*—Book-keeping.

5. *Drawing.*

grammar, the case-rules. Written exercises. Easy historical pieces from the Reader.

8. *English.*—4 h. w. Grammar: Use of the article, adjective, pronouns, and verb. Easy readings from a text-book.

9. *History.*—3 h. w. Conclusion of ancient history. History of the Middle Ages; the German especially, to the end of the interregnum. Tabular review of previous lessons.

10. *Geography.*—2 h. w. The Scandinavian and South-European peninsulas. Russia.

11. *Natural Science.*—2 h. w. Winter semester: Mathematical and physical geography, with reference to geognosy and geology. Summer semester: Botany.

SECOND CLASS.

(32 Hours of Recitation a Week.)

1. *German.*—3 h. w. Theory of style and diction; prosody, metre. Exercises in reading and declamation to illustrate the poetical selections. Exercises in arrangement. Compositions; chiefly easy discussions and development of ethical ideas, along with narratives of travel and personal experiences.

2. *French.*—4 h. w. Review of grammar. Syntax: tenses, moods, and dependent sentences. Readings; chiefly historical pieces from the text-book.

3. *Spanish.*—3 h. w. Grammar: Etymology; regular and irregular verbs; inflection of substantive and adjective; personal pronouns; numerals; passive voice; its equivalent, the reflective. Infinitive, participle, gerund. The verb in its grammatical signification. Difference between *ser* and *estar*. Translations from text-book. Readings from Primary Reader.

4. *Geography.*—2 h. w. Review, England, Asia, Africa.

5. *Mathematics.*—4 h. w. Geometry: Review. The circle. Arithmetic: Radical quantities and logarithms; equations of the first degree with one and several unknown quantities.

6. *Natural Science.*—2 h. w. Physics. General introduction; properties of bodies; attraction, free fall, fundamental principles of statics and dynamics. Chemistry: the principal metalloids and their acids.

6. *Religion.*—Paley's Evidences of Christianity—a Monday morning lesson.

7. *Politics.* — Constitution of the United States.

FIRST CLASS.

(24 Hours of Recitation a Week.)

1. *English.* — "Shaw's Lectures on English Literature."

2. *French.*

3. *Spanish.*—In the place of French for those sufficiently proficient in that language, at the discretion of the master.

4. *Geography.*—Physical geography permitted to be taught.

5. *Mathematics.*—Trigonometry, with its applications, etc., continued. Astronomy.

6. *Natural Philosophy.*

7. *Latin.*—3 h. w. Reading of somewhat difficult historical pieces and descriptions from the Reader.

8. *English.*—4 h. w. Grammar: Irregular verbs. Government of the verb and its relations to the sentence; occasional review of all the inflections. Written exercises. Commercial letters. Reading.

9. *History.*—3 h. w. Conclusion of the history of the Middle Ages; the discovery of America; history of the Reformation; modern history, to Louis XIV. Tabular review of the foregoing course.

10. *Accounts.*—2 h. w. Shares, partnership, bankruptcy; profit and loss; exchange; general review of accounts. Various operations in banking and exchange. Mental arithmetic.

11. *Writing.*—2 h. w.

7. *Religion.*—Paley's Evidences continued. Moral Philosophy. Natural Theology.

8. *Political Economy.*

First Class.

(34 Hours of Recitation a Week.)

1. *Spanish.*—4 h. w. Grammar: Use of the auxiliary verbs, pronouns, prepositions; formation of sentences. Translations of German commercial letters, with a text-book. Reading; rather difficult pieces from the Reader, small plays, letters.

2. *Mathematics.*—3 h. w. Geometry, stereometry, trigonometry. Arithmetic: Combinations. Binomial and polynomial theorems. Equations of the second and third degree.

3. *Natural Science.*—3 h. w. Physics: Light, heat, electricity, magnetism. Chemistry: The lighter metals, the heavy metals.

4. *German.*—4 h. w. History of German literature; general survey of the early periods, with their most important representatives; the 18th century thoroughly. Illustrative exercises in reading and committing by heart, and compositions suggested by the course of study.

5. *Latin.*—3 h. w. Prosody, metre, and the dactylic foot. Virgil's Æneid.

6. *French.*—4 h. w. Grammar: The more difficult rules of syntax; Gallicisms. Exercises in style; letters, dialogues; exercises in conversation. Reading; historical and natural-history narratives, with a text-book.

Supplemental Class.

(Not more than 24 Hours of Recitation a Week.)

1. *Spanish.*

2. *Mathematics.* — Astronomy, Mechanics, Engineering; and the higher mathematics, with some option.

3. *Natural Science.*—Chemistry. Geology.

7. *English.*—4 h. w. Exercises in style. Translations from the German classics into English. Practice in Anglicisms. Commercial letters. The harder pieces from a text-book. Memorizing.
8. *History.*—3 h. w. Modern history, to the Congress of Vienna. Reviews.
9. *Geography.*—2 h. w. America and Australia. Climatology: isotherms, isotheres, isochimenes. General review.
10. *Accounts.*—3 h. w. Accounts current. Foreign trade, invoices, consignments, simple and complex calculations.
11. *Writing.*—1 h. w.

4. *Intellectual Philosophy.*
5. *Logic.*

In three respects the differences between the courses just compared are very marked—in the languages, the natural sciences, and in history and geography. Neither Latin nor German (the analogue of English in the *Handelsschule*) is deemed necessary for the pupils of the Boston High School, though the girls who are only nominally trained for teachers at the Normal School in the same city, are taught both. Nor, after the first year, is any attention given to history. On the other hand, we find political economy, theology, and the basis of American politics —the Constitution—in the High School course; but we may be pardoned for doubting the value of this instruction—we mean in practice. In the matter of singing, the musical capacity of Teutons and Anglo-Saxons is well illustrated by the foregoing tables. To make the *Handelsschule* equal to the Prussian *Realschule* of the first rank, this programme announces that hereafter one hour a week must be added to the instruction in Latin in each class.

The age at which pupils are admitted to the High School is twelve, at least, but in fact is about fifteen, as we have seen. The course is nominally three or four years, but is doubtless determined somewhat by the capacity of each scholar. The third, second, and first classes in the *Handelsschule* (called *Tertia*, *Secunda*, and *Prima*) are regularly passed in two years each; though this time may be shortened by half in extraordinary cases. Mention is made in this programme of the death of a pupil in the first division of the second class (II A), in the winter semester of 1867 (Nov. 7). He was almost sixteen years old. It is easy to compare his attainments with those of a lad who has been one year at the High School, who, to be sure, is still alive. In reckoning the hours of recitation of the latter, we deducted three for recess, two for military drill, and one for the short session of Saturday.

OLD ROGER ASCHAM AND HIS "SCHOOLMASTER."

GENTLE, jolly, courtly, modest, grave old Roger nodded his head to the measure of his last Greek verse, gave his last quaint, wise saw on his favorite art of Teaching, and turned his last sentence, as elegant for its Latinity as for its penmanship, just three hundred years ago. He has left us some thoughts which deserve to have survived the interval since his departure; few, if indeed any, that are quite original; not a few, as is but human, tinged with the scholastic narrowness of his times. If they show but little of deep insight into education as an art, but a dim confused psychologic knowledge as the basis of that art, they still furnish useful hints for its practice, and have always a historic interest at least to all its lovers and professors.

This warm summer day, in this library of one of our oldest colleges, as we sit by the green table, like a monk in his alcove, the old half-familiar face of the good Roger looks up at us from the antique volume. His quaint sentences pipe their childish treble of the bygone age from between the silvery vellum covers, like the spoken words of the old man himself dropping from his thin, pale lips. We will chat with him a little while in the dull, still afternoon, with nobody near but our reader and the big blue fly who is bumping angrily against a fat volume of Pantology, and mumbling to himself, no doubt, that "much study is a weariness of the flesh."

Just now, as the leaves lie, good Roger seems to have been giving his opinion on Teachers' pay. This touches us all; most lively, maybe, when looking out wistfully, these vacation days, toward the far blue hills or dreaming of the breezes of the sea. Let us see what he says:

"It is a pity that commonly more care is had, yea, and that among very wise men, to find out rather a cunning man for their horse, than a cunning man for their children. They say nay in a word, but they do so in deed; for to the one they will gladly give a stipend of two hundred crowns by the year, and loath to offer to the other two hundred shillings. God, that sitteth in heaven, laugheth their choice to scorn, and rewardeth their liberality as it should. For he suffereth them to have tame and well-ordered horses, but wild and unfortunate children; and therefore in the end they find more pleasure in their horses than comfort in their children."

All good muscular Christians should listen to Roger, for he was a fast —perhaps just a little so sometimes, in the present popular meaning of the word—he was a fast friend of all the fine old manly sports of Merrie England, and even wrote a book on the manliest of them; and he loved

now and then a "carouse of wine," and piously "would to God he had a vessel of Rhenish wine, on condition that he paid forty shillings for it." The harmless brotherhood of the musical will find a sympathy in him; for on Master Pembler's advice and urgency thereunto, Roger cultivated earnestly sundry instruments of harmony and waxed cunning therein. On these topics Roger discourseth as follows:

"I do not mean by all this my talk, that young gentlemen should always be poring on a book, and by using good studies should lose honest pleasure, and haunt no good pastime; I mean nothing less. For it is well known that I both like and love, and have always, and do yet still use all exercises and pastimes that be fit for my nature and ability. And beside natural disposition, in judgment also I was never either Stoic in doctrine or Anabaptist in religion, to mislike a merry, pleasant, and playful nature, if no outrage be committed against law, measure, and good order. I would wish that young gentlemen should use and delight in all courtly exercises and gentlemanlike pastimes. Therefore, to ride comely, to run fair at the tilt or ring, to play at all weapons, to shoot fair in bow, or surely in gun, to vault lustily, to run, to leap, to wrestle, to swim, to dance comely, to sing and play on instruments cunningly, to hawk, to hunt, to play at tennis, and all pastimes generally which be joined with labor used in open place, and in the daylight, containing either some fit exercise for war, or some pleasant pastime for peace, be not only comely and decent, but also very necessary for a courtly gentleman to use." "The greatest clerks be not the wisest men."

And here comes something of graver air, which will spread a dry grin of satisfaction over the parchment visages of pedant and pedagogue, from Oxford to Yale, who sit, amid this breathing world, crooning over the dust of defunct antiquity, and had rather shape the graceful imbecility of a Greek or Latin verse than invent a telegraph. Roger's admiration of classic acquirement is quite pardonable. He lived in an age which presented, so to speak, no ideals of its own, which stupidly admired the scholar before the man of action, the man of letters before the man of original investigation; which neglected Shakspeare till a pedant told it to applaud him. The spirit of his remarks on "the making of Latins" will amuse the true educator, who believes that knowledge is valuable only as it gives a present, actual, living power on society and the man's self. In "the ready way to the Latin Tongue," he proceedeth:

"After that your scholar shall come in deed, first to a ready perfectness in translating, then to a ripe and skilful choice in marking out his six points, then choose out some epistle *ad Atticum*, some notable commonplace out of his Orations, or some other part of Tully, by your discretion, which your scholar may not know where to find; and trans-

late it you yourself into plain natural English, and then give it him to translate into Latin again, allowing him good space and time to do it both with diligent heed and good advisement.

"Here his wit shall be new set on work; his judgment for right choice truly tried; his memory for sure retaining better exercised than by learning anything without the book; and here, how much he hath profited shall plainly appear. When he bringeth it translated unto you, bring you forth the place of Tully; lay them together, compare the one with the other; commend his good choice and right placing of words; show his faults gently, but blame them not over sharply; for of such missings, gently admonished of, proceedeth glad and good heed-taking; of good heed-taking, springeth chiefly knowledge, which after groweth to perfectness, if this order be diligently used by the scholar and gently handled by the master."

How Roger must have charmed the hearts of the schoolboys and schoolgirls of his day, by advising and practising the most Christian rule of kind suasion before a hint of bodily coercion! What a gentleman he shows himself in the lines we are going to quote! What a brood of gentlemen—full of that virtue next in worth to true religion, indeed an integral part of such religion—must have grown from such nurture!

"If a child miss, either in forgetting a word or in changing a good with a worse, or misordering the sentence, I would not have the master either frown or chide with him, if the child hath done his diligence and used no truantship therein; for I know by good experience that a child shall take more profit of two faults gently warned of than of four things rightly hit; for then the master shall have good occasion to say unto him, 'Tully would have used such a word, not this; Tully would have placed this word here, not there.'"

"Let your scholar be never afraid to ask you any doubt, but use discreetly the best allurements you can to encourage him to the same, lest his overmuch fearing of you drive him to seek some misorderly shift, as to seek to be helped by some other book, or to be prompted by some other scholar, and so go about to beguile you much, and himself more."

"If your scholar do miss sometimes in marking rightly, chide not hastily; for that shall both dull his wit and discourage his diligence; but monish him gently, which shall make him both willing to amend and glad to go forward in love and hope of learning. I have now wished twice or thrice this gentle nature to be in a schoolmaster."

Good-afternoon, good Roger! May thy healthy piety, thy hearty manhood, thy tactful gentleness, breed like sweetness and strength in many a successor of thy noble office, and through these, all graces in the hearts and minds of the youthful generations yet to come!

GRAMMATICAL NOTES.

XIII.—*Nor* after a Negative.

THERE is a vagueness in the teachings of grammars in reference to the question whether *or* or *nor* should be used to continue a negation after a preceding negative. Most grammars ignore the question altogether. All of them, however, teach that *neither* should be followed by *nor*, and *either* by *or*; also, that a negation requires but one negative word, and that more than one, therefore, are improper, except in cases of repetition for emphasis. These principles are no doubt just; and, if properly followed, perhaps are sufficient. Yet many writers seem not to know how to follow them; or, if they do, they fail to follow them, either from carelessness or from indifference. We are inclined to think the failure is generally to be attributed to ignorance. Even grammarians themselves are found teaching false doctrine in regard to the matter. Wells says, correctly enough, "The negatives *no*, *not*, etc., may be followed by either *or* or *nor*. The use of *nor* serves to repeat the negation; and there are many cases in which it is decidedly preferable to *or*."—*Gram., Revised Ed.*, p. 184. But, among his illustrations, he improperly classes the following as correct: "I know not where to begin, *nor* where to end;" "He never convinces the reason, *nor* fills the imagination, *nor* touches the heart;" "Let not your fancy, *nor* your excited feelings lead you captive." As these sentences stand, the connective word is wrong. It should be *or*, as may be seen by supplying *either* where it is understood; thus, "I know not [*either*] where to begin, *or* where to end;" "He never [*either*] convinces the reason, *or* fills the imagination, *or* touches the heart," etc. Burn, to whom Wells refers, says (Gram., p. 106), "*Nor* follows NOT and *neither*;" and adds (p. 107), "Let *or* be used simply to connect the members of a sentence, or to mark distribution, opposition, or choice, *without any preceding negative particle;* and *nor* to mark *the subsequent parts of a negative sentence with some negative particle in the preceding part of it.*" In illustration of which he gives, together with other examples, the following: "Let *no* man be too confident, *nor* too diffident of his own abilities;" "*Never* calumniate any man, *nor* give the least encouragement to calumniators; ["Here," says Kerl, Comp. Eng. Gr., p. 266, "*or* could not have been used!"] "There is *not* a Christian duty to which Providence has not annexed a blessing, *nor* any affliction for which a remedy is not provided." But, in regard to each of these cases, we cannot but consider John Burn and his followers in error. We

should certainly ourselves write *or* instead of *nor* here; that is, if we must retain the other words, in each instance, just as they stand. Burn himself says, "*Or* follows *either* in a sentence." Now we hold that *either*, though not expressed, is implied in the above sentences, and just as truly belongs to them as though it were expressed. Elegance, *i. e.*, rhetorical propriety (not grammatical) calls for its suppression; that is all. Compare the following: "Let no man be [*either*] too confident, *or* too diffident," etc. "Never [*either*] calumniate any man, *or* give the least encouragement," etc. "There is not [*either*] a duty," etc., "*or* any affliction," etc. It is true, we might say, "There is not a duty, etc., *nor* IS THERE any affliction," etc. But, it should be observed, the words *is there* do not occur in the last clause of the sentence as given by Burn. Kerl says, "*Nor*, and not *or*, is generally required to continue a negative sentence; especially when the latter phrase contains *or*, or is not closely dependent on the preceding clause, or is separated from the negative by several words. Ex. 'I affirm, O Romans, that Appius Claudius is the only man not entitled to a participation in the laws, *nor* to the common privileges of civil or human society.'"—*Eng. Lang.*, p. 187. Then, following in the steps of Burn, he objects to the classic language of Milton in the following lines:

> "Seasons return; but not to me returns
> Day, *or* the sweet approach of even or morn,
> *Or* sight of vernal bloom, or summer's rose,
> Or flocks, or herds, or human face divine."

He prefers what he calls "Goold Brown's emendation"—

> "Seasons return; but not to me returns
> [*Either*] day, *nor* the sweet approach of even or morn,
> *Nor* sight of vernal bloom, or summer's rose," etc.

Burn, consistently enough with his rule given above, would change every *or* in these lines into *nor!*

We desire to be understood. We object to that teaching which requires us, in sentences like the foregoing, to write or say *nor*, and not *or*, in order to continue a negation after a preceding negative word. But we do not say that *nor* should never be used. So far from it, if the power of a negative word is restricted to the word, phrase, or clause with which it stands connected, and the negative is to be continued, *nor*, not *or*, must be used. Examples: "He does not demand repentance, *nor* does Agamemnon show any sign of it."—*N. Am. Rev.*, Oct., 1860. Here, the words *he does*, before the negative of the first clause, not reaching over and forming a part of the second clause, *not* is necessarily limited to the former clause. "The Biscayan was in no sense the countryman of the Valencian, *nor* the Lombard of the Biscayan, *nor* the Fleming of the Lombard, *nor* the Sicilian of the Fleming."—*Macaulay*:

H. Eng. Here, too, the words *the Biscayan*, before the first negative, forming no similar part of the following clauses, the negation expressed by *no* is restricted to the first clause, and needs to be expressed anew by successive *nors*. "They had not seen the various dispensations of Providence, *nor* consequently could be [=*and* consequently could *not* be] acquainted with those many topics of praise."—*Addison.* "Since he has been in office, no plan has been formed, no system adhered to, *nor* any one important measure adopted for the relief of public credit."—*Junius.* If, in the last clause, *any one* were omitted, *or* would be the proper connective; but as *no any one* is not English, the power of *no* does not reach beyond the clause in which the word occurs.

"He sits on no precariouus throne,
Nor borrows leave to be."—*Watts.*

But if a sentence is so framed that the power of a negative word reaches beyond what it primarily modifies and covers subsequent words or expressions, the latter should be coupled to the former by *or*, not by *nor*.[1] "The picture and the painter are not past *or* future to my imagination."—*G. P. Marsh.* "He never harnessed a horse, *or* pulled an oar."—*N. Am. Rev.*, Jan., 1862. "There is no lack of sun *or* of water [in Cilicia]."—*Do.*, Apr., 1862. "Neither of the two Odes has ever been popular, *or* ever will be."—*Do.*, Apr., 1863. "We hold that any new word, honestly born and adapted to general needs and usages, is not American, *or* Australian, but English."—*Do.*, Oct., 1860. "If not the abilities of a great minister, if not the integrity of a patriot, *or* the fidelity of a friend, show us at least the firmness of a man."—*Junius.* "The question no longer turns upon points of national honor and security abroad, *or* on the degrees of expedience and propriety of measures at home."—*Do.* "Christ never found fault with instrumental music; neither did Paul *or* John."—*Boyd: Leisure Hours.*

"No further seek his merits to disclose,
Or draw his frailties from their dread abode."—*Gray.*

On this last, a writer in the North American Review for April, 1863, very justly says: "Mitford has made several technical criticisms of words

[1] In order to see whether the negative does thus cover what follows or not, place a bracket after the negative, or the word or words directly modified by it, and another after the following conjunction—*or* or *nor*. If the sense is complete, or the structure of the sentence correct, with the omission of the words within the brackets, then the negative reaches over; if it is not, the influence of the negative is restricted to its own clause. Ex. 1. The negative reaching over:

"I'm not ashamed [to own my Lord,
Or] to defend his cause."—*Watts.*

2. The power of the negative not reaching over: "I am not [your enemy, nor] did I begin this contest with you."—*Junius.*

and phrases occurring in this poem. Some of the corrections are, however, entirely gratuitous. For instance, the word *or* at the beginning of the second line of the last stanza, as it reads in the printed version, he says, should be *nor*. But either might be grammatically correct; for the clause will bear two constructions equally appropriate, one of which would require the connective *or*, and the other *nor*. If the verb *draw* were an imperative, standing in the same category as, and independent of, the verb *seek* in the first line, the force of the negative connected with *seek* would extend, of course, only to its subsidiary words, and would therefore be exhausted at the end of the first line, with the word *disclose*. For the second line a new negative would then be needed. But *draw* may be an infinitive, with its sign *to* omitted. It would then stand in the same category with *to disclose* in the first line—both being similarly dependent on the leading word *seek;* and the negative expressed with this governing word would then be of force throughout all the subordinate phrases, as far as the end of the second line. In this case, the connective *or* could alone be used. That this last construction was in the mind of the poet—that the word *seek* must be understood as the governing word to the word *draw*—appears from the above MS. version,[1] where *seek* is repeated."

If the use of *or* is likely to render the meaning doubtful, by giving the additional word, phrase, or clause the appearance of an alternative expression, or by failing clearly to denote a negation, or otherwise, the sentence should be so framed as to preclude all ambiguity, and at the same time exhibit a proper use of connectives. Example: "There was *no* excess of fraud *or* cruelty, of which he was not capable."—*Macaulay.* The phrase "no excess of fraud or cruelty" may mean either no excess of either fraud or cruelty, or no cruelty or excess of fraud. If it means the former, the insertion of *of* would remove the ambiguity—"no excess of fraud or *of* cruelty;" if the latter, which seems to us to be the meaning intended, say *no* instead of *or:* "There was no excess of fraud, no cruelty, of which he was not capable." "There was the look of one whom trouble could *not* cast down *nor* subdue."—*Irving.* Here *nor* is improper, as it doubles the negation already expressed by *not.* It would be correct to change *nor* to *or;* but better, we think, to write *neither* instead of *not.* "There is *no* recorded intimation, *nor* the slightest ground for supposing that from the 1st to the 6th century the Greek pro-

[1] The MS. version of this stanza here referred to, is:

"No farther seek his merits to disclose,
Nor seek to draw them from their dread abode—
(His frailties there in trembling hope repose);
The bosom of his Father and his God."

nunciation underwent any change."—*E. Masson.* Here *or* would evidently be wrong; for we cannot say, "There is *no the slightest* ground," etc. *Or* would be correct, if the author had written *not any* instead of *no;* for, in the sentence, "There is not [any recorded intimation, or] the slightest ground," etc., it will be observed, we can omit the bracketed words, and unite the others without violence or offence. Or we may substitute *not* for *nor*: "There is no recorded intimation, *not* the slightest ground," etc. Or, once more, retaining both *no* and *nor*, we may rectify the sentence by inserting *is there* after *nor*: "There is no intimation, nor is there the slightest," etc. "Whenever he came to Isabella, he took *no* notice of Don Diego Columbus, *nor* paid any respect to the council."—*Irving.* Here, again, *or* would be wrong. The subject, *he*, should be repeated after *nor*, "nor did he pay any respect," etc. "The Indians, struck with terror, made *no* resistance, *nor* any show of hostility."—*Do.* *Nor* here doubles the negation. The phraseology may be corrected by changing *nor* to *or*, and omitting *any*—"made no resistance or show of hostility;" or by saying, "neither offered resistance nor made any show," etc. "My object in these notes is *not* to lay down *nor* to exemplify mere rules of grammar."—*Alford.* "A fraction is *nothing* more *nor* less than unexecuted division."—*Eaton's H. Sch. Arith.* These two may be best corrected by changing *not* and *nothing* to *neither*.

Sometimes the negatives are used apparently with very little regard to propriety, so that the sentence, to express the intended meaning correctly, needs to be almost wholly recast. Witness the following: "The king has *no* arbitrary power to give him; your lordships have *not; nor* the Commons; *nor* the whole legislature."—*Burke.* This, after consistently supplying the omitted words, will read, "The king has no arbitrary power to give him; your lordships have not [arbitrary power to give him]; nor [have] the Commons," etc. It should read, "The king has *no* arbitrary power to give him; your lordships have *none;* the Commons *none;* the whole legislature *none;*" or, "The king has *no* arbitrary power to give him; *nor* have your lordships, *or* the Commons, *or* the whole legislature *any.*"

We conclude by saying, with John Burn, that however just the distinction here argued for may appear to us, we would not dogmatically impose our opinion upon any who may think differently in regard to the matter.

EDUCATION is the instruction of the intellect in the laws of nature (under which name I include not merely things and their forces, but men and their ways) and the fashioning of the affections and of the will into an earnest and loving desire to move in harmony with those laws.—*Huxley.*

THE TOTAL ECLIPSE OF THE SUN OF THE 18TH OF AUGUST, 1868.

By Prof. Gustavus Fischer.

THE total eclipse of the sun, which will have happened when these remarks have come to the hand of the reader, will be the most remarkable and important of all the eclipses that have ever occurred.

Total eclipses of the sun, for a given locality on the earth, are of a very rare occurrence. Thus, in London, not a single total eclipse of the sun happened between 1140 and 1715; that is, in a space of 575 years. In Paris only one eclipse occurred in the whole of the 18th century, while during the 19th century not one has happened or will happen in that locality.

Total eclipses of the sun can last no longer than 7 minutes and 58 seconds. This greatest possible duration happens only when the centres of sun, moon, and earth lie exactly in a straight line, and at the same time the sun is at his greatest distance (apogee) and the moon at her least distance (perigee) from the earth; and even then the duration of 7 minutes and 58 seconds obtains only on the equator. A coincidence of these conditions has not happened since the creation of man. The total eclipse of the 18th of August will have a duration of 6 minutes and 50 seconds, owing to the fact that the zone which will be eclipsed is near the equator, while the moon will be in her perigee about 6 hours before the beginning of the eclipse, and the sun in apogee during the month of July, and consequently very nearly so in the middle of August. An equally favorable position has not happened for a thousand years. The fact that the present eclipse will happen about the equator is of the greatest importance, because for this reason the eclipsed locality will extend as far as it possibly can, and will consequently offer the greatest choice among places of observation at the greatest possible distance from each other, so that unfavorable weather is certainly not likely to prevent observation at all the selected places. The array of astronomical talent which has been sent to observe this eclipse, and the means and apparatus placed at the disposition of the observers, is altogether unprecedented. The results for astronomical science will be incalculable, and we desire by our present remarks to enable our readers to appreciate at least the most important of these results.

At sunrise the eclipse will be observed first in the neighborhood of Aden, whither the Pope has sent the Jesuit priest, Father Secchi, equally celebrated as an astronomer and photographer. To the same place are sent the members of the photographic-astronomic expedition of the

North-German Confederation, consisting of Vogel, Zenker, Fritsch, and Thiele, and the members of the Austrian expedition, the former of whom will attend especially to the photographical part. Celebrated chemists will participate in the analysis of the spectrum. In the course of the day the eclipse will be observed at many places in the East Indies by English, French, and German astronomers, and especially on the plateau of Delhan, near the centre of the eclipse, where the most complete preparations have been made. This locality will see the representatives of nearly all the great observatories of the globe. In Borneo and Celebes Danish, English, and Swedish astronomers will observe. The eastern limit of the eclipsed region is New Guinea, north of New Holland, where the eclipse will be observed in the evening by English and French astronomers.

The observations which are made in eclipses of the sun may be divided into two kinds: first, those which refer to the time of the motions of earth and moon; and, second, those which refer to the nature of the sunlight. In regard to the former, we remark here, that *every* eclipse of the sun will serve for a correction of the *elements of the orbits*. The time when the moon enters the disk of the sun, the duration of the eclipse, and the time when the last trace of the moon leaves the edge of the sun, have been calculated beforehand with the utmost minuteness, even for the twentieth part of a second, thanks to the accurate knowledge which our astronomers have of the motions of the earth and of the infinitely more complicated motion of the moon. Now, if the mentioned phenomena happen exactly at the time calculated, they evidently confirm the correctness of the calculations, and of the supposed motions and distances of these heavenly bodies. But if there is a discrepancy even of the twentieth part of a second, the previous calculations must be corrected, and thus every new observation will furnish either a new proof of the absolute correctness of the astronomical calculations, or lead to corrections which finally must approximate this part of astronomical knowledge to a state of absolute perfection.

But by far the most important part of the observations, which will be made in this eclipse, refer to the *nature of the sunlight*. There is a very widely-spread opinion that in a total eclipse of the sun a total darkness prevails, and that the stars become visible. This opinion, though repeated by our astronomical handbooks, is entirely erroneous. Only the very brightest stars become visible. Thus, in the total eclipse of July 18, 1860, the four planets, Mercury, Venus, Jupiter, and Saturn were seen near the sun with the naked eye, and in the total eclipse of July 28, 1851, in Dantzic, Mercury, Venus, Jupiter, Procyon, Regulus, and Spica were visible; but it was in vain that Galle tried to find Castor and Pollux. The fact that during a total eclipse there is only a twilight, but

by no means darkness, is easily explained, when we consider that the atmosphere in places next to the total eclipse will *reflect* the sunlight in all directions, and that by this reflected light those parts of the atmosphere which lie within the total eclipse are illuminated, though feebly. There is no doubt that in the present eclipse the amount of reflected light, present in every part of the eclipsed zone, will be accurately and most minutely measured, to judge from the high perfection of the photometric instruments which are placed at the disposal of the observing astronomers.

But there is another phenomenon which, in the moment of the total eclipse, is presented to the eyes of the observers, so glorious and wonderful that no description can give an adequate idea of it. This is the CORONA, which suddenly appears in the moment when the last ray of the sun disappears behind the deep black cover of the moon: a shining wreath of beams, surrounding the totally eclipsed sun to a distance of about one-third of the apparent diameter of the moon, and so bright at its inner edge that we may doubt whether really the whole sun is obscured, and then fading away imperceptibly in the vast space of heaven. The Corona does not always present the same appearance; it is either of a silvery-white or of a reddish tinge, according to the state of our atmosphere, and sometimes colored rays or pencils of light are seen issuing from it. The halo with which painters surround the heads of saints gives perhaps the best idea of it. It disappears with the first reappearing ray of the sun, as if by magic.

What is the cause of this phenomenon? It must be either in the sun or in the moon. The moon could produce it only if she had an atmosphere capable of refracting the rays of the sun. But since it has been proved that the moon is without an atmosphere, it follows that the cause of the phenomenon must be found in the sun himself.

The following theory was adopted by the best astronomers before the discovery of the spectrum analysis:

If we observe the sun through a good telescope, we see black spots on its surface, irregularly formed, and surrounded with a penumbra, that is, an inner ring, which is less dark, and of an ashy-gray color. These spots often combine into a single, larger spot, or separate into different smaller ones, passing over the disk from east to west in periods of nearly two weeks. Sir W. Herschel, and after him most astronomers, believed these spots to be openings in a luminous atmosphere of the sun, which alone is the cause of the sunlight, and that the sun, whose body those very openings allow us to see, is dark; that this luminous atmosphere (photosphere) is separated from the body of the sun by an inner atmosphere, tending to intercept or to soften the heat and light of the photosphere, and that the penumbra is produced by this inner atmosphere.

But there are several important objections against this theory. Thus it has been observed that the spots, although moving around the surface of the sun, nevertheless retain their shapes often for a long time. But by Sporer's investigations it has been proved that the surface of the sun is perpetually agitated by the most violent and tremendous storms, moving near the equator in a westerly, in higher latitudes in an easterly direction. But how can the spots, if mere interruptions of a gaseous atmosphere, retain their shape, when this atmosphere itself is driven over many thousands of miles in the most violent convulsion? Again, several astronomers have observed that both the spots and their penumbras are traversed by streaks and veins of sunlight. W. Carrington, in Redhill, saw on the 1st September, 1859, an intense white light, brighter than that on the surface of the sun, suddenly emerging from the centre of a large spot. The phenomenon lasted five minutes, and after its disappearance the spot remained unchanged. The same astronomer inspected some days later the photographic magnetic records in Kew, in respect to declination, inclination, and intensity, and found in each of these the traces of a vast disturbance which had occurred exactly at the time of the phenomenon described above. In 1862 the astronomer Nasmyth stated that he had observed in the penumbra of the solar spots things looking like willow-leaves, which placed themselves over each other, like bridges over bridges. In 1863 other astronomers observed the willow-leaves of Nasmyth, and ventured to assert—especially Sir John Herschel—that they might be living beings developing light and electricity. Even the earth was affected by this phenomenon; for at all observatories magnetic storms were observed, all telegraph wires were overloaded, and an aurora borealis trembled on the sky.

It is evident that the hypothesis which we have stated in regard to the solar spots is unable to explain any of these phenomena. Much less can the appearance of the Corona be explained by it. In order to account for the Corona astronomers have resorted to a new hypothesis, the existence of a *third* atmosphere around the sun—a cloudy sphere. This sphere, they say, is invisible under ordinary circumstances, in consequence of the brighter photosphere; but during a total eclipse it will appear as Corona, either with its own light or by reflecting the rays of the photosphere.

But the Corona is not the only, not even the most remarkable phenomenon of a solar eclipse. For at the moment when the last ray of light has vanished, we suddenly behold on the edge of the dark moon strange conglomerations of a pale reddish lustre, which some observers have compared to glaciers, illuminated by the rising or setting sun, others to reddish mountain peaks, others to immovable flames. These protuberances—so they are called—are not always connected with the edge of

the moon or of the sun, but often are separated from it by a considerable distance (up to 2½ minutes). Some, when the moon is about to glide over them, suddenly change their colors, or seem to grow in height, and then new protuberances will make their appearance. These protuberances have especially been seen near those places on the edge, where solar spots had been perceived before the obscuration.

These protuberances were several times observed during the last century, first in 1733 by Bassemius in Gothenburg. But they did not engage the attention which they deserve till Schumacher made his admirable observations in Vienna, on the 8th of July, 1842 : since that time they have been observed by all astronomers with the most minute care during all total eclipses—in 1850 in Honolulu, 1851 in Sweden and Prussia, 1858 in Peru and Brazil, 1860 in Spain. It is for the sake of getting photographic likenesses of the protuberances and the Corona that the host of astronomers, who have resorted to the scene of the present eclipse, have provided themselves with photographic instruments, which, by the skill of Warren De la Rue and Secchi, produced surprising results at the occasion of the last eclipse.

Some astronomers think that the protuberances bear the same relation to the outer or cloudy atmosphere of the sun, as the terrestrial clouds do to our atmosphere. Others consider them as volcanic masses, formed in or below the photosphere, which have penetrated through the openings that appear as solar spots, and perhaps have caused these openings. Others suppose them to be optical phenomena produced by the refraction of light. Some have even considered them as real mountains, which, however, according to their apparent size, would have a height of about 200 miles, if they were on the moon, and of about 60,000 miles if on the sun.

All these problems have entered a new phase since Bunsen and Kirchhoff, ten years ago, discovered the analysis of the spectrum. We will endeavor to give to the reader a brief outline of this splendid discovery, one of the most important of this century, and especially destined to revolutionize the science of chemistry.

Newton discovered that if a beam of solar light be admitted to a dark room through a small aperture and intercepted by a triangular glass-prism, the rays of the sun will be *dispersed* into an oblong, colored figure, which—especially when observed through a telescope—looks like a piece cut from a rainbow, with the known succession of the seven colors, viz., red, orange, yellow, green, blue, indigo, violet. This figure is called the prismatic solar spectrum. The spectra of the planets, but not those of the fixed stars, show exactly the same succession of colors. In the year 1814 Frauenhofer found that the colors of the solar spectrum are not exactly contiguous, but separated by a number of black parallel

lines, which are vertical to the length of the spectrum. These lines, whose number is now known to be nearly 2000, always appear exactly at the same places of the spectrum, however much the angle of the prism may be altered, so that we may consider them as the regular borders of the several groups and shades of colors.

Scientists were in the dark concerning the origin and nature of these lines until recent peculiar discoveries shed an unexpected light on the subject. These discoveries were made by comparing spectra not having their origin in the sunlight. Thus it was found that in the spectrum of chloride of sodium (common salt) the colors appear much darkened, with a very bright *yellow* line at the place where the red color changes into orange. This yellow line is a characteristic proof of the presence of sodium in any body in a state of combustion. *Electric* light does not show any dark lines in the spectrum at all. But if a flame of alcohol, the wick being saturated with sodium, is interposed between the prism and the electric light, a dark line will appear in the place of the bright yellow line. Now, Bunsen and Kirchhoff discovered that the mentioned dark line exactly coincides with one of the lines of Frauenhofer in the solar spectrum, and that the same phenomenon is repeated in innumerable other cases. To each chemical element, treated in this way, corresponds a dark line or a series of dark lines; and if several elements are combined, the corresponding dark lines appear separated without the slightest confusion.

By this discovery an entirely new way of chemical analysis was found. By means of the spectrum may be recognized the presence of the very minutest particles of elements in terrestrial bodies, particles so minute, that by no other method can even a remote approximation to this delicacy be obtained. Thus, the spectrum analysis has disclosed the presence of *one trillionth* of a pound of sodium by means of the characteristic yellow line in the spectrum. We may imagine how enormous will be the result of Bunsen and Kirchhoff's discovery in chemical science. But it is hardly of less importance in astronomy. For the same scholars also made the discovery that there is an essential difference between the spectra of solid and liquid and those of gaseous bodies. Solid or liquid bodies brought to a state of white-heat produce a *continuous* spectrum, in which all the colors are contained without the interposition of dark lines. But gaseous bodies produce bright lines interrupted by dark intervals. Now, when the flame of a gaseous body is interposed between the prism and a white-hot solid or liquid body, the spectrum of the latter at once receives the dark lines of Frauenhofer exactly at the places where the spectrum of the gaseous body has shown the bright lines, while the dark intervals of the latter coincide with the colors of the spectrum.

The inferences which may be made from these facts are palpable. For it evidently follows that the sun must be a white-hot solid or liquid body, surrounded by a gaseous atmosphere, in which a number of elements, some of which are also found on our earth, are in a state of combustion. The body of the sun without this atmosphere would produce a spectrum without black lines. But since we see in the solar spectrum a number of black lines corresponding to the spectra of certain terrestrial bodies, as iron, chromium, nickel, zinc, etc., it follows that these bodies must be present on the surface of the sun, and must be in a state of combustion in his atmosphere. On the other hand, some terrestrial elements, as gold, silver, quicksilver, etc., cannot be present on the surface of the sun, since the lines, formed by their spectra, are not found in the spectrum of the sun. Many experiments have also been made, consisting in the artificial production of new lines in the solar spectrum. Thus, for instance, we find in the spectrum of *lithium* a peculiar red line. If we interpose a lithium-flame between a sunbeam and a prism, a dark line will appear on the same place, where before the red lithium-line was found, and which did not exist before in the spectrum of the sun. We infer from this that lithium is *not* contained in the surface of the sun.

We may now explain the solar spots, the protuberances and the Corona. The solar spots are most probably identical with the protuberances, and both are nothing but clouds, swimming in the atmosphere of the sun, similar to our clouds, which so often appear on the distant horizon as fantastic formations, like the protuberances. The Corona is nothing but this very atmosphere of the sun, of which, under ordinary circumstances, we cannot see anything, since its light is too weak to be perceived next to the intense light of the sun.

Thus the great importance of the solar eclipse of the 18th of August may easily be estimated. For since its duration is longer by several minutes than that of most others, it is to be hoped that an accurate spectrum of the Corona may be obtained; and that in it may be observed the bright lines which are produced by the burning gases of its elements. These results will be secured provided the spectrum so obtained is bright enough to show its different lines with accuracy, which, though a probability, is by no means a certainty.

Perhaps some light may also be shed on the problem of the so-called invisible colors of the spectrum. For, once knowing that the solar spectrum is composed of two elements, which it has hitherto been possible to observe only in their combination, we cannot tell what results may be in store for us, if we are once permitted to contemplate the one of these elements separated from the other.

We have spoken here only of the importance of the spectrum analysis in regard to a more accurate knowledge of the *sun*. But we

may remark that the spectrum analysis is just beginning to enlarge our knowledge of the other stars in an entirely unexpected manner. Thus, we know that in nearly all stars several of the elements of the sun must be present, as, for instance, iron, sodium, magnesium, hydrogen. But there appears also a difference. Thus, in the brightest star of Orion no hydrogen exists, while in Aldebaran the presence of quicksilver is certain, which is wanting on the sun. In the spectrum of Sirius, lines have been found which cannot be produced by any known terrestrial body. We know, at the same time, by the most recent discoveries, that the planetary nebulæ cannot be clusters of stars, as Sir John Herschel thought to have proved by Rosse's large reflecting telescope, but immense masses of gas without a nucleus; for their spectra do not show dark lines on a bright ground, but bright lines with dark intervals.

What a progress of science! How long ago is it that we learned to measure the heavenly bodies? Scarcely a quarter of a century have we known how to find their distances, and not much longer that we have known how to weigh them, as though we could place them in a scale. Now we discover the matter of which they are made, the metals which lie on their surface. We decompose them, as if we held them in our hands—had placed particles of them in the alembics of our laboratories.

ON SCIENCE-TEACHING IN SCHOOLS.[1]

AS the subject of the teaching of science in schools is being discussed in these columns, it may perhaps conduce to the settlement of the question if I offer a few suggestions from a practical point of view.

It will be scarcely necessary to consider the position of those who think that science should be made the basis of education. It is possible that the training of the future may take this form, which is so ably advocated by Mr. Herbert Spencer; the attempt which is being made in France to create an *enseignement secondaire special*, of which the backbone is mathematics, and in which science takes precedence of literature, may offer a lesson or a warning to coming generations. But in our time the supremacy of literature is not likely to be overthrown, partly because it is probably the best training for the majority, partly because it has in its favor the prescriptions of many years, but chiefly because adequate teachers of science cannot be found. The new scheme of education in France, to which I have above referred, cannot be put into action until

[1] Chemical News, July, 1868.

the Normal Schools of Cluny and Mont Masan have sent forth several generations of professors. The problem which we have to solve is, after admitting that science is ancillary and subordinate to literature in education—to decide what science is to be taught and what means are to be used in teaching it.

There is at present great want of a recognized programme of scientific study. In founding scholarships for natural science there appears to be a great difficulty in arranging the limits and scope of the examination. The witnesses examined on this subject before the Public Schools Commission do not agree; each one asserts that his own subject is admirably fitted to be an educational instrument, but he does not attempt to define the place it should hold in a general scientific education, or the relations which it bears to its competitors. The only subject which several scientific men agree in recommending is applied mathematics. They urge the study of mechanics and hydrostatics at schools. There is scarcely a school in England where mathematics are not taught to every scholar, and there are, I should imagine, few minds which are incapable of apprehending mathematical reasoning. At Eton it is frequently found that the best classics are also the best mathematicians. There can be no reason why applied mathematics should be more difficult of apprehension than the pure science, and it would seem advisable to introduce the teaching of statics, dynamics, and hydrostatics into all schools, treating the subjects both mathematically and experimentally, so that they may form a link between the two branches of science; and there can be no reason why these subjects should not be obligatory upon all the scholars.

After this we leave our certain ground, and are obliged to feel our way with greater caution. Various authorities have recommended the teaching at schools of botany, geology, physiology, natural history, physics (*i. e.*, heat, electricity, magnetism, etc.), and chemistry. It is obvious that if science in the whole mass is to be subordinate to literature, and if pure and applied mathematics are to be taught compulsorily to all, that the whole range of these subjects cannot be made part of the regular school-course, unless they are to be taught with an unreal and delusive shallowness. We must make a selection, and the only safe principle appears to be, that each of these studies is suited to a different mind, and that Nature herself indicates which is the most proper to be taught to each individual.

We cannot speak with any certainty of the process of growth in the human mind. But by careful watching we seem to arrive at the conclusion that the faculties of each mind are evolved in an order peculiar to that individual. There is nothing more capricious or inexplicable than the steps by which the full manly growth is arrived at from the size of childhood. If you take twenty boys at eleven years old, with some

knowledge of their parentage, you may predict what development they will have reached at twenty-five. But you cannot indicate the steps by which this development is to be attained, or the age at which the most critical change will occur. It would seem to be the same with the mind. Experience of boys' minds tends to show me that they are not generally indolent or inactive; that if they are surrounded by healthy conditions, they are really desirous of growth and nourishment. The chief difficulty of the teacher is to discover the precise food which is required at a given time. If this is offered, it is received and assimilated with the greatest ease and rapidity. The most perfect possible education would be given by supplying at the right moment the intellectual food for which the healthy mind was craving. The most astonishing results in education have been produced where very able men have given their whole thoughts to the education of very able boys. This is impossible at a public school; there must be a fixed curriculum of some kind, and this we have decided is to be literature and mathematics. But the various branches of science I have above enumerated are admirably suited to be applied as alteratives to the jaded mind, and to excite the appetite for knowledge which may have been dulled by application to the regular studies.

Sciences which possess a complex terminology are often acquired with ease by very young children. A boy whose tastes lie in that direction, will learn the names of a great number of flowers and insects before he is ten years old; and in cases where this appetite for accumulating names is not directed to a useful subject, it has recourse to heraldry or stamp-collecting, or some similar pursuit. The existence of this power in childhood may not indicate any faculty of grasping scientific truth in the mature man, but it stores the mind with facts which would be learned far more laboriously at an advanced age. It frequently happens that a dull, sluggish scholar has his mind assailable by some particular branch of science. I may mention some cases of this which have come under my notice. It would be well if schoolmasters could adopt the plan of describing their cases of education as methodically and accurately as a doctor describes his cure. In this way a mass of information might be collected which would be of the greatest service in forming a true theory of education.

A., aged 14, stupid in classics and mathematics, fond of chemistry experiments and of mechanical contrivances. Attended a course of lectures with "Roscoe" as a text-book; answered questions on the first twelve chapters of "Roscoe;" read "Hofmann's Chemistry" with a competent teacher; begged to be allowed a chemical tutor in the holidays, and worked with him through "Conington's Analysis;" if he works well, will be fit for a foreign university in a year's time; his gen-

eral intelligence has wonderfully brightened, and his love of work increased.

B., aged 14, clever in classics, fair in mathematics, generally cultivated in language and history. Studies chemistry in "Roscoe" and "Hofmann;" gives most of his time to geology in "Lyell" and "Juke," which he knows thoroughly; is well acquainted with the geology of Scotland and the Isle of Wight; spends his leisure time in arranging fossils; read "Darwin's Cruise of the Beagle" twice, and the "Origin of Species" with avidity and intelligence.

C., aged 13, very fair in classics and mathematics; has read a great number of books on entomology, which is his special study; knows "Kirby and Spence" almost by heart.

D., aged 16, very dull in the regular work; has written a good and exhaustive book on the birds of two English counties; is devoted to ornithology.

These cases are drawn from a small area, and are perfectly well known to me. In each case the study of their particular science has made them more generally bright and intelligent, but they do not show any desire to learn the sciences which lie outside the circle to which they have devoted themselves.

Now, science may be taught in three ways—1st, as a collection of facts useful to be known; 2d, as a training of the observing and reasoning powers; and 3d, as a means of educating those who are destined to be workers in that particular field. The first of these is not to be despised. A knowledge of leading physical facts should be a part of all education; it may help to guard against misconceptions where it does not give actual knowledge. It is best imparted by lectures; and I should believe that one or two lectures given by the very best informed men in the several subjects, would be more effectual than many lectures given by men of inferior brilliancy. A system of itinerant lectures to great schools by great men would be a powerful educational engine. Besides, it is only by these lectures that the special aptitude can be discovered or called into existence. The sight and voice of great discoverers may fertilize latent germs of kindred genius.

The second aspect of scientific study has been dwelt upon with force and eloquence by Mr. Wilson on several occasions. He has shown how the study of science may train the mind in that which ought to be the end of all teaching—accuracy of thought and accuracy of expression. But nearly all sciences will do this equally as well, and many branches of a literal and mathematical training will do it also; and no branch of science is likely to do it effectually unless the interest and attention of the learner be first excited. It is quite true that the pursuit of truth is at present a characteristic of science, but it should also be a character-

istic of theology and morals, philology and history. Teaching has, by the indolence and bigotry of mankind, degenerated in many cases into the mere enouncing of ready-made conclusions, which are to be accepted without question by the hearer. Science still dwells upon the heights, and breathes the pure air of divine philosophy. But is there no trace of such attachment to ascertained truths in the history of science itself? Were not the discoveries of Fresnel suppressed by older savants, who feared their revolutionary character? and does not M. Duruy suspend the professor of physiology whose conscience leads him to the conclusions of materialism? The introduction of science into schools may serve to emancipate our existing teaching of other subjects; but it may also find that it has entered into the house of bondage, and in any case it is not the only study which is fitted to brace and exercise the mind for the search after pure and simple truth. The calculus of reasoning which science imparts is analogous to that of mathematics, philology, logic, or metaphysics. But I question myself if it is not a coarser and less powerful engine of thought than that by which a sheet of Thucydides is translated, or a passage of the Choephoræ restored. The third end of scientific teaching is all-important. It is of the utmost moment to the country that no special talent should be lost to it. Our little army of explorers, in all branches of art, science, and literature, is not so large that it can dispense with recruits, while the adaptation of the outward circumstances of existence to the requirements of the development of the inner nature is the only means of assuring a harmonizing and happy life. Every boy who is capable of receiving an education by means of any branch of physical science, should have the fullest opportunity and encouragement to do so. I think I have by this time indicated the precise action which I would advocate.

1. That no exact study of science should be compulsory except that which is closely connected with mathematics.

2. That lectures should be given on all branches of science by distinguished men, for the purpose of giving useful information and stimulating the zeal of those who are likely to devote themselves to any branch of the subject.

3. That accurate teaching in chemistry, botany, geology, natural history, and the various branches of physics not included in applied mathematics, should be provided to all who show a special aptitude and desire for the study, and that such boys should be excused so much of the school curriculum as would enable them to study the subject with profit and advantage.

I must now conclude this very hasty sketch of the kind of science-teaching which I think should be provided in schools. The greatest danger which we are running in England in the matter of education is

of adopting a too extended curriculum, which must necessarily be shallow. They are discovering in France, Germany, and Holland, that they have made this mistake. But in these countries every thing is regulated by a ministerial programme, and the only method of consulting special aptitudes is by introducing a system of bifurcation, which answers as badly abroad as it does in England. But in our great English public-schools the freedom from control among the boys, and the close and affectionate relation between the tutor and the pupil, gives scope to a liberty of learning and a liberty of teaching, which we are told is the informing spirit of the German universities. To these two great principles we ought to cling. The advocates of new studies only succeed in proving that they are good engines of education. They do not convince us that we should abandon the old studies or force the new upon all. De Tocqueville left us a warning that we should not become *polytechnises*, as Frenchmen are. The real advance in education lies in the reverent and loving watching of each human soul, the guarding it from all influences which may confine or distort its growth, and the surrounding it with all the food it asks for the support of its daily life, that by the gradual progress of individual development it may arrive at a mature character which will find the world in which it lives in accord and harmony with its aims and aspirations. If this training were adopted by us, a public school would present a rich variety of character which philosophers think that our modern society is certain soon to lose. And in obtaining this diversity, science has to play a very important, if not the chief or leading part.

The painter who takes long rambles in search of scenery for his pictures, or the civil engineer who rides through tracts of country, observing all their characteristics with reference to the shortest and most profitable route for a railroad, has mind and body simultaneously exercised, and is consequently ten times more invigorated than a man who does the same amount of riding or walking under the direction of a physician, with no other object than a vague pursuit of health. And he who studies for some definite use, has immensely the advantage over him who pursues the same study merely as a prescribed accomplishment in the routine of education. A man who studies mathematics merely as part of a course laid out for him by tutors, may be able to solve difficult problems as readily as the man who earnestly applies them to the construction of machines; but the mental vigor acquired in the latter process will be tenfold greater than in the former.—*L. Maria Child.*